

Radio Frequency Identification (RI

Radio Frequency Identification (RFID)

Policy & Implementation

Defense Acquisition University December, 2005



Major Briefing Points

- Policy
- Implementation
- Early Applications w/ Lessons Learned
- Final Thoughts
- Resources



Major Briefing Points

Policy



The Benefits of RFID for

DoD

RFID allows:

- Non line-of-site/hands-free data capture
- Reduction in human intervention

Resulting in Improved:

- In-transit and asset visibility
- Timeliness and accuracy of shipping, receiving, and transportation
- Flexibility and confidence in the DoD Supply Chain





AND ultimately improved support to



DoD's RFID Goals

- Increase Warfighter/Customer Confidence in the Reliability of the DoD Supply Chain
- Improve Visibility of Information and Assets throughout the DoD Supply Chain
- Improve Process Efficiency of Shipping, Receiving and Inventory Management
- Reduce Order Ship Time and Customer Wait Time



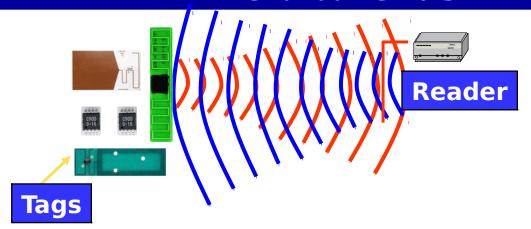
General Overview What is RFID?

- It is only one of a host of Automatic Identification technologies
- Specifically, RFID is a means of identifying an item based upon a radio transmission signal
- With some exceptions, the kinds of objects that RFID can either detect, identify, or track is wide and varied
- RFID communication occurs between a READER (the Interrogator) and a TRANSPONDER (a silicon chip connected to an antenna)
- The transponder is usually referred to as a TAG



Radio Frequency

RFID: The fundamentals



What is RFID?

- •A means of identifying <u>a unique</u> <u>object or person</u> using a radio frequency transmission
- •Tags (or transponders) that <u>store</u> <u>information</u>, which can be transmitted wirelessly in an automated fashion
- Readers (or interrogators) both stationary and hand-held <u>read/write</u> <u>information from/to tags</u>

How does it operate?

- RFID tags are <u>affixed to objects</u> and stored information may be written and rewritten to an embedded chip in the tag
- •Tags can be <u>read remotely</u> when they detect a radio frequency signal from a reader over a range of distances
- Readers display tag information or send it over the enterprise network



Automated Identification Technology Suite

Linear Bar Cod

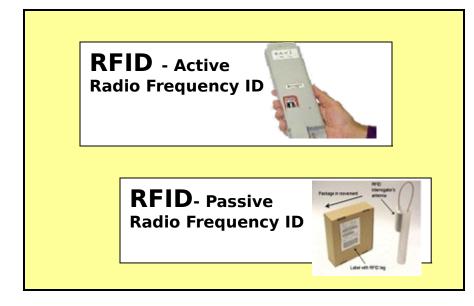


OMC
Optical Memory Ca

STS
Satellite-Tracking Syste









RFID Policy Memorandum

July 30th 2004

- Finalizes the Business Rules for use of high data capacity Active RFID
- Finalizes business rules for phased implementation of Passive RFID and the use of Electronic Product Code™ (EPC) interoperable tags and equipment within DoD Supply chain
 - Army's PEO Enterprise Information Systems (PEO EIS)
 continues development of a multi-vendor contract mechanism
 to procure EPC technology
- Includes Three Attachments
 - Business Rules for Active RFID Technology
 - Business Rules for Passive RFID Technology
 - Supplier Implementation Plan



RFID Policy Memorandum Specifics

- Internal DoD AIS funding will hinge on compliance with this policy
- That all DoD Suppliers will use EPC Compliant tags
- That DoD will migrate to the UHF Gen 2 Standard in approximately 2 years
- That RFID Policy will be written into the following documents:
 - DoD 4140.1-R: DoD Supply Chain Material Management Regulation
 - DoD 4500.9-R: The Defense Transportation Regulation
 - DODI 5000.2: Operation of the Defense Acquisition System
 - MIL-STD 129P: Military Marking for Shipment and Storage



Electronic Product Code™

(EPC) Background

- Auto-ID Center at MIT designed a system for bringing the benefits of Radio Frequency Identification to the global supply chain
- That system is comprised of the Electronic Product Code ™ (EPC), RFID Technology and supporting software based on EPCglobal standards.
- EAN International and the Uniform Code Council, Inc. (UCC) chosen as implementation partners
 - Formed EPCglobal Inc.™ which is a an open, worldwide,not-for-profit consortium of supply chain partners

EPCglobal Network Infrastructure/Components

- Electronic Product Code Unique Number that identifies a specific object in motion in the supply chain
- ID System EPC₁Tags and EPC readers
- EDC Middleware Manages basis read information

Attachment 1 Business Rules for Active RFID Technology

- Rules apply to ALL DoD Components
- Rules specifically apply to OCONUS Shipments
- Reconfigured shipments must have the Tag updated
- "RFID recorded events will become the automatic transactions of record"
- PM J-AIT will assist with frequency spectrum issues

Attachment 2 Business Rules for Passive RFID Technolog

- RFID technical standard EPC compliant
- RFID technology will not cover bulk commodities

- Electronic Data Interchange (ASN in MIRR via WAWF)
- Considered Normal Cost of doing Business
- PM J-AIT will assist with frequency spectrum issues



Attachment 3 Supplier Implementation

Plan

- Roadmap targeting specific commodities and critical distribution functions at following types of sites:
 - DLA Depots
 - Depot Maintenance Activities
 - TRANSCOM Strategic Aerial Ports
- Phased implementation by type of commodity and distribution site
 - 2005: Certain items to DLA Distribution Depot San Joaquin or Susquehanna,
 - 2006: Additional items; Service depots plus DLA sites;
 TRANSCOM Air Mobility Command Terminals
 - 2007: Supply classes have been identified by 2007 at individual case level, palletized loads; multi-pack pallets; and units containing a IUID item.



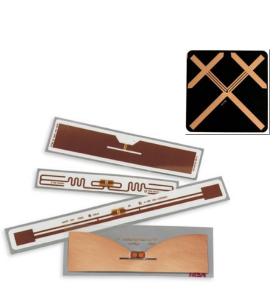
The Scope of the Policy

Active RFID - freight containers, air pallets, large engines

- SAVI 433 Mhz readers
- SAVI tags
- DoD tag data formats
- Suppliers rarely obligated to apply tags

Passive RFID - case, pallet (all items), item packaging (UID items)

- EPC std UHF readers
- EPC Class 0 & 1 std tags
 - Migration to EPC UHF Generation 2 std
- EPC and DoD tag data formats
- Suppliers will be contractually obligated to apply tags





"TAG" Types

Passive Tags

- Rely upon an external RF energy source in the form of an Interrogator/Reader
- Best used when the tag and interrogator will be close to one another
- Used on Cases and Pallets

Active Tags

- Use an internal power source in the form of a battery
- Used when a longer tag read distance is desired
- Used on shipping containers and 463L pallets



Passive RFID Tag

Data

Acceptable EPC tags:

- Class 0 64-bit Read Only
- Class 1 64-bit Write Once Read Many (WORM)
- Class 0 96-bit Read Only
- Class 1 96-bit Write Once Read Many (WORM)
- UHF, Gen 2 (when available)

Acceptable tag data constructs:

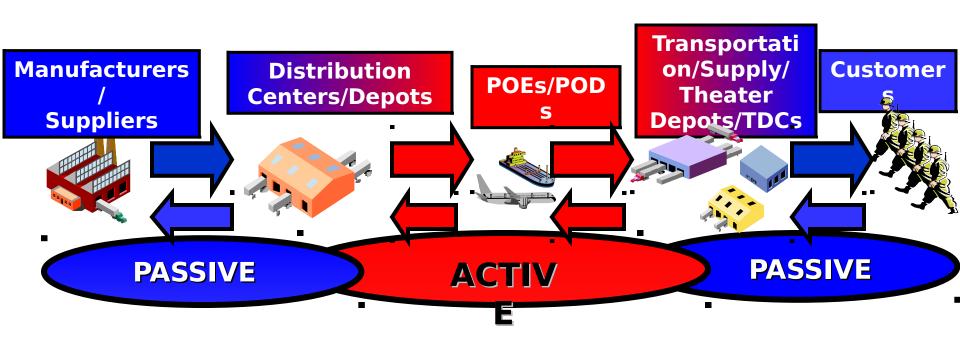
- Serialized Global Trade Item Number (SGTIN)
- Global Returnable Asset Identifier (GRAI)
- Global Individual Asset Identifier (GIAI)
- Serialized Shipment Container Code (SSCC)
- DoD construct

DoD will only accept EPC



Complementary Use of Active and Passive RFID Technology Across the

Supply Chain





RFID Policy

The Policy memo with Attachments and other information are at the RFID Homepage

http://www.dodrfid.org

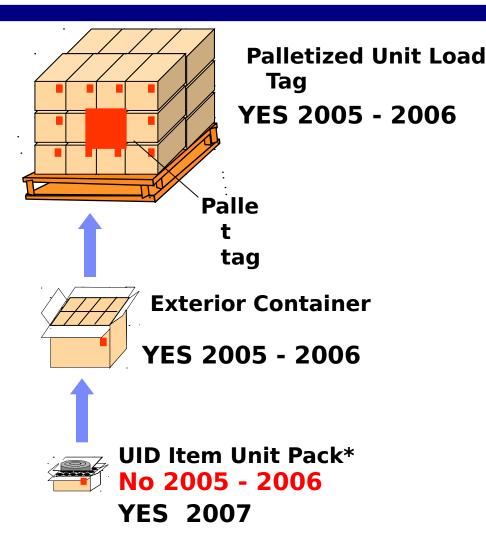


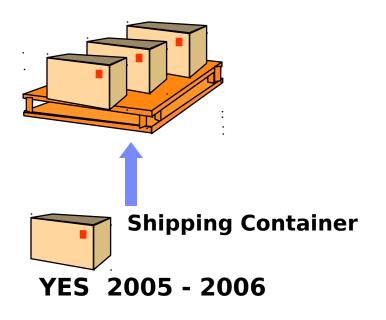
Major Briefing Points

Implementation



Implementation Plan: Level of Packaging







Implementation Plan: Commodities

2005

- Class I Subclass –
 Packaged Operational
 Rations & Packaged
 Food
- Class II Clothing, Individual Equipment, Tools, & Administrative Supplies
- Class VI Personal Demand Items
- Class IX Repair Parts
 & Components

2006

- In addition to Class I Subclass, Class II, Class VI, & Class IX
- Class III (P) Packaged Petroleum, Lubricants, Oils, Preservatives, Chemicals & Additives
- Class IV Construction & Barrier Equipment
- Class VIII Medical Materials (Only Medical/Surgical Equipment)

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DoD S

DoD Sites Coming On-Line in

2006

- Air Force Logistics Centers
 - Ogden, UT
- DLA Defense Distribution Depots
 - Albany, GA
 - Anniston, AL
 - Barstow, CA
 - Cherry Point, NC
 - Columbus, OH
 - Corpus Christi, TX
 - Ogden, UT
 - Jacksonville, FL

- Oklahoma, OK
- Norfolk, VA
- Puget Sound, WA
- Red River, TX
- Richmond, VA
- San Diego, CA
- Tobyhanna, PA
- Warner Robins, GA

TRANSCOM Air Mobility Command Terminals

- Charleston, SC
- Dover, DE
- Fairfield, CA (Trazs AFB)



Passive RFID Implementation Plan

for DoD Suppliers

2005

Classes of Supply:

II, VI, IX, I (PORs/MREs)

Level of Tagging:

 Shipping Containers, Palletized Unit

Loads, Exterior Containers

Ship to locations:

San Joaquin, Susquehanna

60,000 DoD

Manufacturers/Suppliers
DFAR - new and revised
contracts

Classes of Supply

Level of Tagging

Ship to Locations

2007

Classes of Supply:

All Classes will be tagged

Level of Tagging:

 Shipping Containers, Palletized Unit Loads, Exterior Containers, Unit Pack for UID Items

Ship to locations: All Locations that will be instrumented

2006

Classes of Supply:

 I (PORs/MREs), II, III, IV, VI, VIII (Medical/Surgical Equipment)

Level of Tagging:

 Shipping Containers, Palletized Unit Loads, Exterior Containers

Ship to locations:

 Strategic CONUS DLA Depots, TRANSCOM Facilities & Service Maintenance Facilities



Passive RFID Implementation Plan for DoD Suppliers

2005

Classes of Supply:

■ II, VI, IX, I (PORs/MREs)

Level of Tagging:

- Shipping Containers
- Palletized Unit Loads
- Exterior Containers

Ship to locations:

- San Joaquin, CA
- Susquehanna, PA

2006

Classes of Supply:

Additional Classes; III
 (P), IV, VIII
 (Medical/Surgical)

Level of Tagging:

- Shipping Containers
- Palletized Unit Loads
- Exterior Containers

Ship to locations:

- Strategic CONUS DLA Depots
- TRANSCOM Facilities
- Service Maintenance Facilities (decision

2007

Classes of Supply:

 All Classes that will be tagged

Level of Tagging:

- Shipping Containers
- Palletized Unit Loads
- Exterior Containers
- UID Item Unit Pack

Ship to locations:

 All locations that will be instrumented



Gen 2 phased in



Contractual

Requirements

- Two Major Requirements for Suppliers
 - Passive Tagging at the case & pallet level IAW Implementation Plan
 - Transmission of an Advance Ship Notice (ASN)
- General Requirements
 - Data encoded on tag must be unique
 - Passive Tag is readable at time of shipment IAW MIL-STD 129
 - Tag is placed in an appropriate location on the specified level of packaging
 - Contractor shall use specified tag constructs [EPCglobal]
 - Contractor shall electronically submit Advance Shipment Notices



Final DFARS Rule

- DFARS 211.275-2 Policy: "RFID, in the form of a passive RFID tag, is required for individual cases and palletized unit loads that contain items in any of the following classes of supply" [2005 List]
- " ... and will be delivered to one of the following locations:
 - Defense Distribution Depot in Susquehanna, PA
 - Defense Distribution Depot in San Joaquin, CA. "
- DFARS 211.275-3 Contract clause: "Use the clause at DFARS 252.211-7006 in solicitations for contracts that will require delivery of items meeting.

Final Clause Effective November 14th 2005



DFARS Clause

- DFARS 252. 211-7006:
 - (a) Definitions
 - ASN to Shipping Container
 - (b) (1) Except as provided in paragraph (b) (2) of this clause, the Contractor shall affix passive RFID tags, at the case and palletized unit load packaging levels, for shipments of items that:
 - (i) Are in any of the following classes of supply
 - » Subclass of Class I (POR); Class II, VI; IX
 - (ii) Are being shipped to: Defense Distribution Depots Susquehanna, PA & san Joaquin, CA.
 - (2) Bulk commodities are excluded



DFARS Clause 252.211-

- (c) The Contractor shall ensure that -
 - (i) The data encoded on each passive RFID tag are unique (ie, the binary <u>number</u> is never repeated on any contract) and conforms to the requirements in paragraph (d) of this clause
 - (ii) Each passive tag is readable at the time of shipment IAW MIL-STD-129P (section 4.9.1.1)
 - (iii) The passive tag is affixed at the appropriate location on the specific level of packaging, IAW MIL-STD-129P (section 4.9.2)
- (d) Data syntax and standards. The Contractor shall use one or more of the following data constructs depending on type of passive RFID tag being used iaw the tag construct details located at

http://www.dodrfid.org/tagdata.htm



DFARS Clause 252.211-

(continued)

 (e) The Contractor shall electronically submit advance shipment notice(s) with the RFID tag identification (specified in paragraph (d) of this clause) in advance of the shipment in accordance with the procedures at:

http://www.dodrfid.org/asn.htm

The ASN is not a new process/transaction. It is the same existing Material Inspection Receiving Report (MIRR) transaction being sent to WAWF with additional data (RFID data elements) added to the transaction.



Passive RFID Tag Data

Construct

Header 2 or 8 (64 bit/96 bit)

Filter Value 3 bits

Partition (96 bit only) 3 bits

Company Prefix/CAGE 20; 20 - 40

Code Depends

Item reference/Asset Type Depends

Sorial Number

Fields of the construct are combined to create

a single unique binary number which is burned into the RFID tag

http://www.acq.osd.mil/log/rfid/tag_data.ht



Performance Requirements TAG Readability

- For RFID Tags passing thru a PORTAL
 - Palletized Loads via Forklift
 - At 10 miles per hour
 - Read distance must be at least 3 Meters, or ~ 10 Feet
- For RFID Tags moving on a CONVEYOR BELT
 - Individual containers
 - At 600 feet per minute
 - Read distance must be at least 1 Meter, or ~ 40
 Inches



Recommended TAG

Placement

- A few key points about tagging material
 - The RF Tag may be integrated with the Shipping Label
 - Place the Tag on case, container or pallet in such a way that:
 - Physical damage is minimized
 - The highest potential for successful interrogation can occur
- Some Tagging "Don'ts"
 - Do NOT place a tag over a seam
 - Do NOT cover a tag with sealing tape or banding
 - Do NOT overlap another RF Tag (at least 4" of separation)



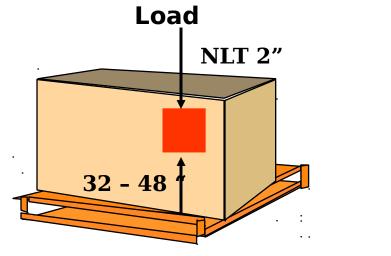
Recommended TAG

Placement*

Tag Placement on an Exterior Container



Tag Placement on a Palletized Unit



*MIL-STD 129P Chg 3 October 2004



Data Constructs

- 2005 DoD will accept 64 or 96 bit Class 0 and/or 1 EPC Tags
- Policy Memorandum of July 30, 2005 Attachment 2 Paragraph 2.5 <u>Passive UHF RFID Tag</u> <u>Specifications</u>
 - EPCglobal™ Subscribers use an EPCglobal™ tag data construct
 - Non-EPCglobal™ Subscribers use the DoD tag data construct
- Constructs at: http://www.dodrfid.org/tagdata.htm



Option 1: Buy Pre-Coded Tags/Labels

Meeting the Requirement

- Pre-encoded tags from tag OEM
 - EPC or DoD Construct
 - Case or Pallet Filter Value
 - Hexadecimal # Printed on
- EPC Members use EPC Mgr No.
- Others use CAGE Code

Tagging and Data

- Tag case/pallet at pack/ship point
 - Apply per MIL-STD-129
- Send ASN via WAWF
 - Web-entry method/UDF/856
 - WAWF guide for

Infrastructure and Cost

- Minimal investment
 - Existing IT resources
 - Internet connectivity
 - Pre-encoded tag stock
- Lowest \$\$ investment



Option 2: Buy Pre-Coded Tags/Labels: Verify Readability

Meeting the Requirement

- Pre-encoded tags from tag OEM Verify Tag ID with Reader
 - EPC or DOD Construct
 - Case or Pallet Filter Value
 - Hexadecimal # Printed on
- EPC Members use EPC Mgr No.
- Others use CAGE Code

Tagging and Data

- Tag case/pallet at pack/ship point
 - Apply per MIL-STD-129
- Reader inputs Tag ID into IT for ASN
- Send ASN via WAWF
 - 856 EDI/UDF to WAWF

Infrastructure and Costry method/format

- Small investment
 - Existing IT resources
 - Internet connectivity
 - Pre-encoded tag stock
 - Reader
 - Reader software
- Low \$\$ investment



Option 3: Print Own Tags/Labels; Verify Readability

Meeting the Requirement

- Blank Class 1 tags from tag OEM:
- Encode/verify tags with reader
 - EPC or DOD Construct
 - Case or Pallet Filter Value
- EPC Members use EPC Mgr No.
- Others use CAGE Code

Tagging and Data

- Write Tag ID with Reader
- Tag case/pallet at pack/ship point
 - Apply per MIL-STD-129
- Reader inputs Tag ID into IT
- Send ASN via WAWF
 - 856 EDI/UDF to WAWF
 - Web-entry

Infrastructure and Cost format

- More infrastructure investment
 - Existing IT resources
 - Internet connectivity
 - Blank RFID Class 1 tag stock
 - Fixed or Hand-Held Readers
 - Robust read/write software
- Larger \$\$ investment



Option 4: Print Own Tags/Labels; Write MSL; Verify

Readability

Meeting the Requirement

- Blank Class 1 tags in Label stoc
- Encode/verify tags & write MSL
 - Single "Smart Label"
 - EPC or DOD Construct
 - Case or Pallet Filter Value
- EPC Members use EPC Mgr No.
- Others use CAGE Code

Tagging and Data

- Write Tag ID & MSL data with RFID equipped printer - print "smart label"
- MSL/Tag on case/pallet at pack/ship
 - Apply per MIL-STD-129
- RFID Printer inputs Tag ID into IT

Infrastructure and Costia WAWF

- More infrastructure investment
 - Existing IT resources
 - Internet connectivity
 - Blank RFID Class 1 tag stock
 - RFID reader equipped printer
 - Robust read/write software
 - Printer controller software
- Larger \$\$ investment

- WAWF EDI/UDF to WAWF
- Web-entry method/format



Option 5: Full RFID Integration

Meeting the Requirement

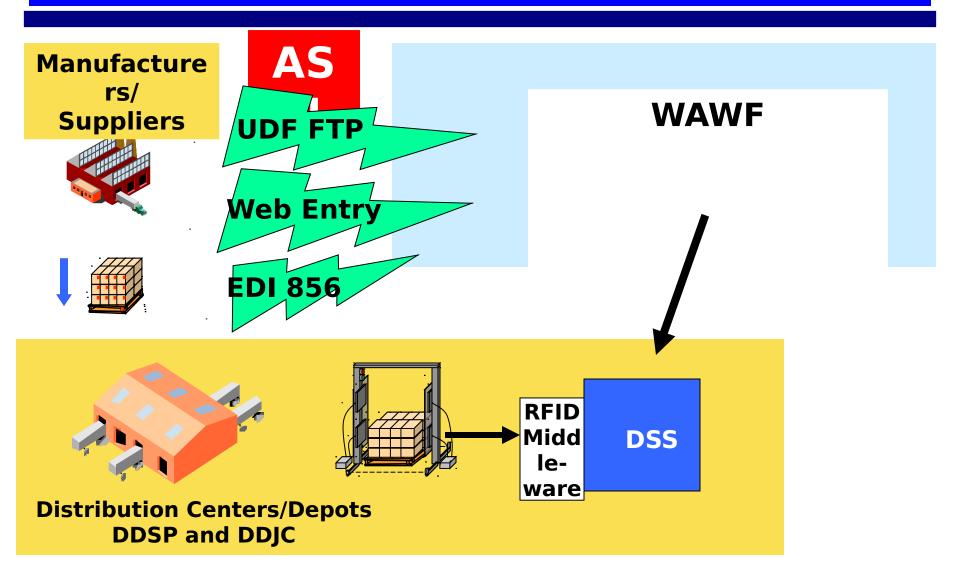
- Blank Class 1 tags in Label stock
- Blank Class 1 tags
- Encode/verify tags & write MSL
 - Single "Smart Label"
 - EPC or DOD Construct
 - Case or Pallet Filter Value
- Encode discrete tags with fixed or I
- EPC Members use EPC Mgr No.
- Others use CAGE Code

Tagging and Data

- Write Tag ID & MSL data with RFID equipped printer print "smart label"
- Encode discrete item tags (as req) with fixed readers or HHRs
- MSL/Tag on case/pallet at pack/ship
 - Apply per MIL-STD-129
- RFID printer & readers input Tag ID into IT
- Send ASN via WAWF
 - WAWF EDI/UDF to WAWF
- Infrastructure and Cost method/format
- More infrastructure investment
 - Existing IT resources
 - Internet and EDI connectivity
 - Blank RFID Class 1 tag & Label stock
 - RFID reader equipped printer (s)
 - Fixed and HHRs
 - Robust Edge SW and MW
 - Printer controller software
 - Servers for Edge SW and MW
- Large \$\$ investment



RFID Data Flow





Use of Wide Area Workflow (WAWF)

Applies to vendors providing Services and/or Products



- Create invoices & Receiving Reports
- Electronically route Receiving Reports to the DOD agencies
- Monitor status of documents as processed by DOD agencies
- Access documents and ONLY correct the required data
- In April 2005, WAWF added the RFID tag ID as an additional data element in the MIRR
- Requires Registration with Central Contractor Registry (CCR)



Major Briefing Points

Early Applications with Lessons Learned



Passive RFID Project @ FISC

- Pilot Site: Ocean Terminal Division, Container Freight Station
- Goal: Increase manifest accuracy and inventory accountability by reducing the number of errors
- Reference: http://www.acq.osd.mil/log/rfid/lessons_learned.htm
- Key Lessons Learned:
 - Passive RFID technology is not a panacea
 - Antenna placement critical to "good reads"
 - The Final Pilot Report notes 25 other lessons
 - Constant training of employees (Tag placement, etc.)
 - Tagging various types of material (Liquid vs Metal vs Rounded material)
 - Back-scatter effect
 - Customizing "portal" design
 - Quality of Tags
 - Work Around Procedures must be developed



Corps Distribution Center Balad, Iraq

- Operational Site: LSA (Logistics Support Area)
 Anaconda
- Mission: Cargo Processing Point for multiple classes of supply
- Reference: Published article, <u>Army Logistician</u>, Mar-Apr 05, Pg
 28
- Key Lessons Learned:
 - Hand-Held Scanning essential in an austere environment
 - "Tie" RFID tags on each case to the TCN on Mixed Pallets
 - Automation has its limits in austere environments
 - Pay special attention to labeling and tag location
 - Manual "work-arounds" are mandatory
 - Training is essential



Lessons Learned Business Processes

- Analyze, redesign if necessary, your business processes when integrating Passive RFID technology into your operation to realize maximum benefit
- Implementation Pilot sites show improvement in data accuracy (3%) and processing time (39%)
- For those sites that integrate RFID technology into redesigned business practices, reliability of read rates average 96%
- For those sites that introduce RFID technology into existing business practices <u>without change</u>, reliability of read rates average 50%



Lessons Learned The Architecture

 System integration may pose a challenge

Caused by the complex nature of the supply chain

Supporting AIS may require different data elements and formats to support the business processes at a given supply chain node

- A modular and easily adaptive architecture is recommended
- Integrating RFID HW/SW with existing legacy data systems and its technical support environment can take significant time and effort to complete



Lessons Learned The Technology

- Passive RFID is a transformational technology
 - Military effectiveness can be improved
 - Inefficiencies in the supply chain can be reduced
- Pilot studies to date indicate a reliable read rate of RFID tags at fixed portals in the 90% range
- RFID hardware is 100% reliable
- Those limitations in the technology can be eradicated, or substantially mitigated, thru the introduction of smart business changes



Lessons Learned The People

- Effective education and training is a must
- A structured approach to process improvement will help overcome any misgivings or misconceptions about Passive RFID technology and the valuable role it can serve in any supply chain operation
- Continuous two-way communication among all personnel involved in an implementation is encouraged



Opportunities from RFID

lagging

Opportunities From Passive RFID Tagging

High

Opportunities

low

PALLET TAGGING

- Product Diversion
- Vendor-Managed Inventory
- Production Planning
- DC/Goods Receipt
- Put-Away
- Inventory Control and Storage

CASE TAGGING

Inventory Reduction
Labor Efficiencies
Throughput Increases
Case Shrink
Retail Out-of-Stock
Demand Planning
Supply Planning
Subcontracting/Repacker Visibility
Pick, Pack & Ship
Track & Trace

ITEM TAGGING

- Out-of-Stocks
- Store-Level
 Promotions and
- Pricing Enhanced
- Consumer
- Experience
- Safety Stock Reduction
- Unit/Item Shrink
- Pay-on-Scan
- Consumer
- Understanding
- Product R&D
- Aging/Quality
 Control 5+ years

months

Time to Implement



Major Briefing

Points

Final Thoughts



The Bottom Line

"RFID helps you get good inventory information into the system if you have good business processes to gowy the Integral Quoted in RFID Journal, Jan-Feb '05" "I Want YOU to Tag Your Shipments"



The RFID Vision

Implement knowledge-enabled Logistics Through Fully Automated Visibility And the Management of Assets In support of the Warfighter





Next Steps

- Final DFARS Rule
 - Implement 2006 & 2007 Policy Objectives
- Perform Safety Certification Testing (HERO, HERF, HERP) for passive RFID
- Execute: Ship and Receive Tagged Materiel



Major Briefing

Points

Resources



Resources

- DoD Suppliers' Passive RFID Information Guide, version 7.0
- MIL-STD-129P w/Change 3 of 29 October 2004

Radio Frequency Identification (RFID) h ttp://www.dodrfid.org

(Office of the Assistant Deputy Under Secretary of Defense (Supply Chain Integration))



Other Resources

RFID Team

info@dodrfid.org

EPC Global

http://www.epcglobalinc.org

Wide Area Workflow (WAWF)

https://wawf.eb.mil

Procurement Technical Assistance Centers (PTAC)

http://www.dla.mil/db/

PM J-AIT (PM Joint-Automatic Identification Technology)
www.eis.army.mil/AIT



FAQ Form

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Send to: rfidtraining@dau.mil